Adaptive VAR compensator for industrial/and commercial applications

"The Adaptive Voltage Amps Reactive Compensator (AVC) is a tool which helps an industry to manage its reactive power and allows a utility to better utilize its electricity generation system and distribution capacity. The benefits of AVC include reduced system losses, better voltage regulation and less power consumption. The support of Natural Resources Canada and the Ministry of the Environment helped us to develop and manufacture this unique AVC system."

Bill Argue, P. Eng.
Vice-President, Haefely-Trench
Scarborough, Ontario

Two 2400 kVAR AVCs (installed at Seagirt Marine Terminal).

THE COMPANY

Haefely-Trench develops and manufactures high voltage technologies. The company owns four plants in Scarborough, Ont. which sell electrical power products such as dry type air core reactors, instrument transformers, transformer bushings and AVCs nationally and internationally.

THE CHALLENGE

The challenge was to help companies which use electrically driven equipment with variable work cycles such as pumps, elevators and arc furnaces, close the gap between the total amount of power (kVA) an electrical utility sends and the amount of power which really does the work (kW). The difference between the two is called reactive power (kVAr).

The ratio of the real power to the total power measures the efficiency of an electrical installation. In an ideal world this ratio, which is called the power factor, equals one. Many companies though have a power factor of less than one. That may cause problems for the company, the utility and its other customers.

The abrupt changes in the work cycles of equipment such as elevators, presses and arc furnaces creates corresponding changes in the reactive power. That causes surges in the power supply which may result in rapid and large fluctuations in voltage. This voltage flicker reduces the equipment's efficiency, increases operating costs and displaces capacity in the utility's transmission system.

Many utility companies now set a minimum power factor which their customers must meet or pay a penalty.

In the past, most techniques to compensate for the fluctuating demand of reactive power have relied on mechanically-switched capacitors (which hold excess electricity) until it was needed. But this equipment has proven to be too slow to cope with the rapid and frequent changes in reactive power. Further, the switching mechanisms themselves have generated temporary high currents which then disrupted equipment that use microprocessors, such as computers.

Some very large users of electricity solved their problem by using Static Voltage Amps Reactive compensators. But this solution had its drawbacks, not the least of which was its reactive-power cost of some $200 to $300 per kVAr and the amount of room the equipment required for installation. In short, this solution was beyond the physical and financial reach of many companies.

THE SOLUTION

In 1992, Haefely-Trench acquired the world-wide rights to a unique technology for a voltage amps reactive compensator. The company developed the technology further, then built and tested a commercial prototype of the AVC.

The AVC is a bank of capacitors with solid-state switches. It is capable of compensating for rapid changes in demand because of reactive power — usually within one cycle.

The AVC monitors the voltage and current flowing through each phase of electricity to determine the amount of capacitance (the ability of a capacitor to hold an electric charge) which must be connected to each phase to compensate for the fluctuations.

The independent phase sensing of the reactive current means the AVC can switch the capacitors of each phase independently. Further, the switches are activated by light and isolated optically from the electronic circuitry. This eliminates the effects of electromagnetic fields and allows the AVC to be connected to high voltage power lines.

Companies can run the AVC in automatic or manual mode, either at the plant by using a portable computer or from another site by using a modem. The AVC is a stand-alone device which can be installed indoors or outdoors. The cost for low voltage units is about $50 per kVAr but increases at higher voltages and lower kVAr.

THE RESULTS

The AVC can save a company up to 15 per cent on its electricity bill and reduce the failure of equipment. The technology allows utilities to reduce reactive power demand, lower electricity losses and increase their efficiency.

The first Canadian AVC units were installed in 1994 at Monroe Automotive Equipment in Owen Sound, Ont. The company had a payback of about one year and has subsequently ordered more AVCs.

Haefely-Trench has since built a new plant to make AVCs. Production started in 1996 and 14 people now work there. By early 1998, the company had sold 43 AVC units worth more than $5 million in Ontario and the United States.

OPPORTUNITIES

The AVC technology can improve the power factor and power quality as well as extend the life of equipment in a wide range of commercial and industrial settings including:

- hospitals;
- mines;
- high rise buildings;
- wind generators;
- pulp and paper, lumber and steel mills;
- utility distribution feeders;
- electric rail systems.

If the AVC technology was used throughout Canada, then the average power factor would be raised to 1.0 from the current level of 0.85 and save more than two million gigajoules (GJ) of energy each year. The market for AVC technology is estimated at $500 million just to raise the national average power factor to 0.9.

Such large savings in energy would enable utility companies to defer construction of new generating plants and distribution lines.

PARTNERSHIP IN POLLUTION PREVENTION AND RESOURCE CONSERVATION

Industrial companies located in Ontario may seek ministry and industry services that will help them to:

- use energy more efficiently;
- reduce, reuse and recycle solid waste;
- reduce or eliminate liquid effluent and gaseous emissions.

Equipment and supply service companies can benefit from the information provided on technologies identified for business development.

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MINISTRY OF THE ENVIRONMENT SERVICES

For information on Ministry of the Environment assistance to industry, please contact the Industry Conservation Branch at (416) 327-1492, Fax (416) 327-1261.

For more project profiles and other publications, visit the ministry's website at http://www.ene.gov.on.ca

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This project profile was prepared and published as a public service by the Ontario Ministry of the Environment. Its purpose is to transfer information to Ontario companies about new environmental technologies.

Pour tout renseignement en français au sujet des services d'écologisation industrielle du ministère de l'Environnement, veuillez composer le 416 327-1253. Télécopieur : 416 327-1261.

Printed on recycled paper

500 - 05 - 98 PIBS 3354E86